Page 1, lines 9 - 18:

--In the term "food" product, I intend to include animal food, confectionary and medical products. The inventor's two (expired) patents US-A-4,115,502 and ~~WO~~ US-A-4,436,568 disclose such products. The former discloses:

a) strands of viscous sugar solution, interspersed with strands of dough; ~~and~~ the coextruded sheet formed product is subsequently baked - and;

b) strands of highly viscous, dissolved or swollen protein and a viscous sugar solution, caramel and/or dough; the coextruded sheet formed product is subsequently solidified. (see col. 6, line 65 to col. 7, line 5 of this patent).--

Page 2, lines 6-7:

--The food product according to this invention is characterised as follows: A three-dimensional food product, elongated in at least one dimension (the z-dimension) and consisting of at least two components which have been coextruded to become interspersed with each other, in which one or more cells of components A are surrounded at least in the xz plane by one or more components B which form cell walls surrounding the A component characterised in that the or each B component is a solid (including a viscoelastic solid) at 20°C the cells of components A are arranged in at least two mutually distinct rows extending generally in the z direction, each said row of cells being separated from the adjacent row by a generally continuous (in the z-direction) boundary cell wall of B component, and either a) A having no compressional yield point (being a fluid) at 20°C or having

plastic, pseudoplastic or viscoelastic consistency at 20°C and having a compressional yield point YP^{A20} at 20°C which is less than 0.5 x the compressional yield point of B at 20°C (YP_{B20}) or b) A being an expanded material containing at least 50% by volume gas.--

Page 4, lines 27-28;

--Specific examples of the nature of components A and B are as follows:

a. B is based on fat, oil or wax with additions for the taste, and preferably consists of chocolate;

b. B is based on protein;

c. B is a microporous agglomerate of particles containing water in the pores, and said particles consist of short fibres or grain, -shell- or film-pieces or flakes, which particles are bonded together by polymeric micro-strands, e. g. consisting of coagulated gluten or a natural or synthetic rubber as produced by coagulation of a latex;

d. B is or contains a gel based on a polymer belonging to the group of carbohydrates or carbohydrate related compounds.

e. B comprises a polymer and the boundary cell walls of B extending in a generally z direction are molecularly oriented in the general z direction;

f. A is a juice optionally in the form of a soft gel or with a thickening agent and is flowable, and contains dissolved sugar;

g. A is a juice optionally in the form of as soft gel or with a thickening agent, and contains hydrolysed proteins to give it taste and nutritional value comparable to meat;

h. A contains a pulp of short protein fibres or pieces of protein film;

i. A is a cultured milk product;

j. A is marzipan;

k. A is a paste based on meat;

l. A contains gas;

m. A is based on expanded and baked starch and B is based on protein; and

n. B comprises cheese. --

Page 5, lines 11 - 14:

--The cross section of cells of A in the xz plane generally has an average dimension in the z direction in the range of 0.5 to 10 mm, preferably in the range of 1 to 5 mm. Generally the cells of A have an average cross sectional area in the xz plane in the range of 0.5 to 100 mm^2, preferably in the range of 1 to 25 mm^2.--

Page 6, lines 1 - 7:

--The most advantageous row-formed cell structure is the composite structure with boundary cell-walls and, branching off herefrom bridging cells-walls, in a generally x-wards direction. ~~,~~ ~~f~~ For instance as ~~stated in claim 3 and~~ illustrated in fig. 1a, ~~.~~ the boundary cell wall is formed of a component B_1 and the product has bridging cell walls branching from and extending at least part way in a generally x direction towards the adjacent boundary cell wall, the bridging cell walls being formed at least in part of a B component B_2 being different from B_1. In this drawing there are shown two B-components B1 and B2 (and the reasons for using 2 B

components as shown will be given below) but the drawing must be understood so that B1 and B2 can be one and the same component.--

Page 6, lines 29 - 30:

--The additional cell-walls serve to perfect the nesting of A in B, and are illustrated in fig. 1b, c and d. As can be seen from these figures, each of the cells of A extends part way between the two xz faces, and two or more cells span the distance between the two xz faces and are separated from one another in the y-direction and there are B components arranged between adjacent cells of A which are separated from one another generally in the y direction and forming cell walls around each A cell, so that the A cells are substantially enveloped by cell walls of B. The B component can be formed of a single component and there are bridging cell walls branching from and extending at least part way in a generally x direction towards the adjacent boundary cell wall and around each cell of A.

Page 6, line 31 - page 7, line 14:

--A and B may in fact each comprise more than one component. Very advantageous example of B comprising 2 components B1 and B2 (joined adhesively with each other) ~~and~~ is illustrated in figures 1a and b, ~~4a~~ and 6a and b, B2 preferably exhibiting a compressional yield point which is at least double that of B1. In the arrangement described in the preceding paragraph, the boundary cell wall is formed of at least two different components B_1 and B_2 and the product has bridging cell walls branching from and extending at least part way in a generally x direction towards the adjacent boundary cell wall, the bridging cell walls being formed at least

in part of B_2. More preferably the yield point YP_{B120} of B_1 at 20°C is in the range of 0.1 to 0.5 of the yield point YP_{B220} of the B_2 at 20°C. The B2 may be tougher than B1 (in the final state of the product) depending on the method of manufacture and further dealt with later so that B1 easily is disrupted by the chewing to release the (tasty) A -, while the consumption of B2 requires more chewing work - which is felt as a good combination. Furthermore when B2' is less deformable than ~~B1~~ B1' in the state it has during and immediately after the dividing in the coextrusion process, B2' helps to achieve the most regular cell structure. (In this specification the extrudable material used to make A of the final product is referred to as A' during the process; likewise extrudable B' forms B after processing, B1' forms B1, B2' forms B2 etc).--

Page 7, lines 15 - 19:

--~~These aspects are dealt with in connection with method claims.~~

In one embodiment of the method of the invention, B1 is twisted around cells of A. The twisting can take place by the flow alone when the ~~extrusive~~ extrusion conditions for this are selected so that the segments of A' rotate. This is further explained in connection with fig. 7a, b and c.--

Page 8, lines 21 - 30:

--According to a ~~In the~~ first ~~independent~~ method aspect of the invention ~~claim, a method is defined~~ which is suitable for producing the new product (though not restricted thereto)~~.~~, a food product is manufactured by coextrusion in an extrusion die in which

the components are extruded in a z-direction from the extrusion die, and in which at least one extrudable component A' is formed into a flow through a channel and an extrudable component B' is formed into a flow through a channel, the flow of B' being x-wise adjacent to the flow of A, x being transverse to z, in which the flows of A' and B' exit from the channels through exits after which, the flows of A' and B' are regularly divided in a generally x-direction by a dividing member to form at least two rows of flows of A' and B' separated in the x-direction, in each of which row the flows of A' and B' segmented in the z direction and in which in each said row a segment of flow of B' is joined upstream and downstream to each segment of flow of A' whereby B' segments are interposed between adjacent A' segments in the z direction whereby B' segments are interposed between adjacent A' segments in the z direction and in which adjacent rows are joined to one another along their yz faces, each row of segmented flows of A' forming a row of cells of A' extending generally in the z direction and wherein after the joining of the segmental flows B' is transformed to a solid material (including a viscoelastic solid) B, or, if B' is already viscoelastic, is transformed to a material B having a compressional yield point which is at least twice that of B'. In ~~the~~ this method, cells of A are formed by extruding an extrudable material A' and coextruding an extrudable component B' which forms ~~D~~ B and in the method flows of A' and B' are adjacent to one another in a direction transverse to the z direction, the flows of A' and B' being regularly divided generally transverse to the direction of flow by a dividing member to form flows of A' and B'

segmented in the z direction, a segment of flow of B' being joined upstream and downstream to each segment of flow of A, the process being characterised in that B' is transformed to a harder material B after extrusion, the yield point being at least 20g cm^2.--

Page 8, line 31 - page 9, line 3:

--In the first aspect of the method of the invention, after exit from the extruder B' ~~as~~ is modelled around A' segments so as to surround the A' segments substantially completely in an xz plane. Furthermore, preferably A' is formed into at least two flows, and two rows of segments of A separated by a boundary cell wall of B are formed to form the novel product.--

Page 9, lines 4 - 8:

--~~The claims define further~~ According to a second method aspect of the invention, ~~. This aspect is defined in the second independent method claim.~~ two materials A' and B' are extruded in an extrusion die in which at least one extrudable component A' is supplied from a reservoir for A' and is formed into a flow through an extrusion channel to an exit for A' from the channel, and at least one extrudable material B' is supplied from a reservoir for B' and is formed into a narrow flow through an extrusion channel to the exit for B' from the channel, in which the flows of A' and B' are each divided at or after the respective channel exits to form segments of respective extrudates each by a dividing member which moves relative to the extruder exit between a first and a second position in which the respective channel exit is open to traverse the entire channel exit, and the flows of both A' and B' out of the extrusion channels are intermittent in nature, controlled either by

providing a ram close to or within each channel which drives the flow intermittently or by opening a valve between the inlet to the respective extrusion channel and the reservoir from which the component is supplied under pressure, the movement of the ram or the opening of the valve, as the case may be, being co-ordinated with the relative movement between the dividing members and the channel exits such that material is driven through the exits while the relative movement is stopped in said first and second positions but is not driven through the exits during the change of positions. Preferably several flows of components A' are formed interposed with flows of B'. The dividing members reciprocate or rotate relative ~~s~~ to the extruder exits to form segmental streams whilst modelling B' around A'.--

Page 10, lines 4 - 17:

--Whilst the invention has been described, and ~~it~~ is described in the following description as being from a conventional flat-die, with components and directions defined by reference to an orthogonal system based on the x, y and z axes, the dies may alternatively be circular, in which case the coordinates could alternatively be replaced by r, θ and z. The direction of the extrusion, that is of flow of A' and B' from the extruder exits may be in the z direction, the r direction (either inwardly or outwardly directed) or substantially the θ direction. Where the extrusion is in a generally z direction or generally r direction, the dividing members preferably rotate or reciprocate in the θ direction. Where the material exits from the extruder in a r direction or θ direction, it may alternatively be possible to

reciprocate the dividing members in a z direction. Apparatus adapted from the inventor's earlier apparatus described in US-A-~~3,511,743~~ 3,511,742 or US-A-4,294,638, both based on circular dies, could be utilised in such embodiments.--

Page 12, lines 3 - 7:

--B', on the other hand, (or B1' if there are two B-components in the arrangement shown in fig. 1a and ~~4a~~ 6a) should at this stage of the process be of a fluid to plastic consistency and generally exhibit a lower resistance to permanent deformation. It should preferably have plastic consistency in order to make the extruded product self-supporting as it leaves the die.--

Page 12, lines 18 - 26:

--In order to optimize the shaping of the segments in the dividing process, this should preferably take place by shear between on one side the internal orifices through which the mutually interposed narrow flows are extruded, and on the other side the row of dividing members, and furthermore best by cutting action. The different ways of realising the cutting are as follows:

a. Each orifice is arranged in close proximity to or directly contacting its dividing member, whereby the dividing takes place by the shear between the exit walls and the dividing member;

b. The dividing of each flow to segments is performed by a cutting action;

c. The cutting is performed by forming the upstream end of each dividing member generally as a knife on one x-directed side of the dividing member, the edge of the knife pointing generally in a

direction parallel to the relative movement of the dividing member;

d. The cutting is performed by forming each of the orifices walls generally as a knife at least on one x-directed side, the edge of the knife pointing generally in a direction parallel to such relative movement; and

e. In order to enhance the effect of cutting, each orifice and/or each dividing member performs relatively fast and relatively small vibrations relative to each other generally in the y-direction these vibrations being in addition to the slower and bigger reciprocations along the direction defined by the line of orifices, whereby the knives perform a sawing action. Examples of the shape and positioning of the knives for this action are shown in figures ~~6a~~ 7a and 9. By means of the severing action and/or the "microsawing" specified ~~in claim 86~~ above, it is possible to form very fine slices of the components even when these contain pulp or fibres.--

Page 13, lines 17 - 24:

--A very advantageous way of achieving the modelling of B' around the segments of A' is by merging flows of component B' with each flow of A' before this meets the extruder orifice, this merging being on both sides (in the x direction) of A' to form a composite flow of B'A'B' configuration. In a preferred embodiment, there are several x-wise separated composite flows B'A'B' and the orifices through which such composite B'A'B' streams are extruded alternate (generally along the x-direction) with orifices through which plain B' component is extruded, whereby immediately after the dividing the segmental streams will consist of a transverse row of

B'A'B' segments alternating with B' segments. Generally speaking, two generally yz surfaces of each segment of A' are covered mainly by the part of B' which is joined with A' prior to the dividing. and the two xy surfaces of the segment of A' is covered mainly with B' from those internal orifices which carry B'-component alone. This provides improved possibilities for controlling the thickness of the B' layer in contact with the dividing member.--

Page 13, line 25 - page 14, line 9;

--A modification of this preferred embodiment of the method comprises the use of two B'-components B1' and B2'. It is shown in principle in fig. ~~7a~~ 6a and b, and with further details of the entire extrusion in other drawings as will become apparent from the detailed description of the drawings. According to this preferred embodiment, there are two B' components B1' and B2' to become modelled together around each segment of A', and B1' is merged with A' to form composite flows B1'-A'-B1' as described above, and B1' in a similar manner is merged with B2' to form composite flow B1'-B2'-B1', and the orifices for the composite B1'-A'-B1' flows alternate (in a generally x-direction) with the exits for the composite B1'-B2'-B1' flows whereby immediately after the dividing the segmental streams will consist of as transverse row B1'-A'-B1' segments alternating with B1'-B2'-B1' segments. In connection with the description of product there has already been discussion of the advantages of this modification, and it was mentioned that, provided B2' is less deformable than B1' in its state during and immediately after the dividing, B2' helps to achieve the most regular structure. ~~This should be understood so B2' should~~

~~normally be easier to bring to flow than B1'. However, the higher flowability will mean that the backpressure tends to squeeze a B2' towards the walls of the dividing members, whereby the "boundary cellwalls" may become thicker than wanted, while the "bridging cellwalls" may become thinner than wanted. The use of B2' component which shows more resistance to flow than B1' can fully solve this problem.~~ B2' can ~~also~~, if wanted, have exactly the same composition as B1', but be fed into the extrusion apparatus at a lower temperature to give it higher resistance to deformation, e.g. it may be semifrozen.--

Page 14, lines 10 - 18:

--It has already been mentioned that in many cases the nesting of the segments of A' in B'' is most advantageously a full encasement. The method of the invention comprises two alternative embodiments (which can be combined) to achieve such structures, one being ~~and~~ illustrated in figs 7b and 11b. This alternative is characterised in that in the dividing process there is also interposed one or more layers of B' between adjacent segments of A' separated from one another in the y-direction by making each internal orifice for A' interrupted at one or more locations along the y axis without making the orifices for B' interrupted, whereby the shear will establish the interposing and formation of the layer or layers of B' extending in a generally xz plane. Each orifice for A' is provided with ribs extending across the exit in a generally x direction to create such interruptions, and B' is sheared over the surface of A' segments by provision of shear

plates each of which is aligned to be in the same generally xz plane as the respective ribs.

Page 14, lines 19 - 23:

--After the extrusion process, component or components B' must be transformed to a firm cohesive form (optionally this transformation may already start before the dividing process) while component A' may remain generally as it was during the dividing, or be transformed ~~either~~ to become more "fluid" ~~or more fragile~~.--

Page 14, lines 24 and 25:

--The several alternative options for transformation of B' (which may in some cases be combined) are as follows:

a. The extrusion is carried out at an elevated temperature and the transformation of B' takes place by cooling;

b. The transformation of B' takes place by coagulation or gel formation which can be established by heating or is carried out by chemical reaction, for example, a chemical reaction wherein preformed solid particles are coagulated to continuous firm material, or when the gel formation can be made sufficiently slow, the gelling reagent or coagulant is incorporated into B' prior to the coextrusion process, such as by incorporation into solid particles suspended in B', or by including a reactant in A', this reactant gradually migrating into B' component when the components are brought together in the coextrusion die.

c. Prior to the coextrusion process B' is formed as an extrudable material by disruption of a continuous, firm gel structure, and after the end of the coextrusion the continuous firm structure of this gel is reestablished by heating followed by

cooling, or, if the gel is adequately thixotropic, spontaneously or upon storage;

d. The transformation of B' takes place by coagulation or gel formation by enzymatic action, for instance involving a protease such as rennin to break down and coagulate milk protein;

e. The transformation partly occurs by precipitation in B' of an inorganic salt, e.g. calciumphosphate, formed by reaction betweeen ions in A' and ions in B'; or

f. B' is water-based and the transformation of B' takes place by cooling to a temperature below the freezing range of B'.

Page 16, lines 18 - 20:

--Keeping in mind that A in the final product must be more flowable than B or ~~contain~~ be expanded with gas, A may in some cases remain in the same generally plastic, gel-form or foam-form state which it had (as A) during the dividing and modelling processes, but in most cases it should either be transformed to a more flowable ~~or more fragile~~ form, ~~. More flowable~~ especially when a juicy performance is wanted in the mouth when the "cellwalls" have been broken by chewing.--

Page 21, lines 20 - 23,:

--Referring to the ~~terms in the claims~~ designations in the drawings, (2) are the boundary cell walls, (3) the rows of A-cells, (4) the bridging cell walls extending generally in zy planes and xy planes, and (5) the bridging B-cell walls extending generally in the xz plane.--

Page 22, lines 4 - 7:

--However, still with reference to figs. ~~2 a and b~~ 1a and b, B1 can be identical with B2, i. e. there will be only one B-component. It will become clear from the apparatus drawings with connected description how these different products can be made.--

Page 25, lines 3 - 7:

--As B' is coextruded on each side of A' to a conjugent ~~B1'A'B1'~~ B1'A'B1' flow prior to the dividing, it may furthermore be coextruded on each side of B2' to a conjugent B1'B2'B1' flow. In that case the boundary cell walls will consist of a combination of B1 and B2 as it appears from fig. 6a.--

Page 28, lines 17 - 23:

--Finally, fig. 7b shows that transport belt ~~(33)~~ (22) which takes up the extruded product, and on which there normally are carried out further operations. It also shows a ~~flab~~ flap (23) which should be adjustable. This is not mandatory but can be a help for adjustment of the back-pressure in the exit part to avoid on one hand the occurrence of cavities in the extruded product, and failing flowing-together of the segmental steams in the exit part (44), and on the other hand an exaggerated pressing flat of the segments of A' components.--

Page 33, lines 18 - 34, line 2:

--Instead of establishing the pulsating extrusion by means of rams, it can also be done under use of a valve arrangement as shown in fig. ~~9~~ 8d. Between the fixed inlet part (24) and the reciprocating "interpositioning part" (25) there is inserted a shutterplate (46), which also follows the movements of (25) indicated by the double arrow (11), but superposed on this

movement, (46) is driven forward and backward relative to (25) - see double arrow (47) - by means of an actuator fixed to (25) (not shown). In firm connection with (25) there is a coverplate (48). Both shutterplate (46) and coverplace (48) have 3 rows of slots, (49) for the A' component, (50) for the B2' component, and (51) for the B1 component. These slots in (48) correspond exactly to the respective channels in (25), and the slots in (46) exactly match those in (48) when the shutter stands in position "open", while the shutterplate completely covers the slots in (48) in position "closed". Before this shutter arrangement there is not installed any devices to produce pulsations in the extrusion pressure. This system is mechanically simpler than the ram extrusion, however, due to frictional problems it is slower.--

Page 43, lines 20 - 24:

--Components B1' and B2': identical compositions, namely 50 parts by weight egg white powder + 150 parts oats bran + 180 parts water. At -1.5° C it shows approximate yield point 25 g cm^2, this temperature is chosen for B1'. At ~~30~~ 3° C ~~is~~ it shows approximate yield point 1,6kg cm^2, this temperature therefore is chosen to B2'.